

4.1 ENVIRONMENTAL HEALTH

WAC 463-42-352 Built Environment—Environmental Health.

(1) Noise — *The applicant shall describe the impact of noise from construction and operation and shall describe the measures to be taken in order to eliminate or lessen this impact.*

(2) Risk of fire or explosion — *The applicant shall describe any potential for fire or explosions during construction, operation, standby or nonuse, dismantling, or restoration of the facility and what measures will be taken to mitigate any risk of fire or explosion.*

(3) Releases or potential releases to the environment affecting public health, such as toxic or hazardous materials — *The applicant shall describe any potential for release of toxic or hazardous materials to the environment and shall identify plans for complying with the federal Resource Conservation and Recovery Act and the state Dangerous Waste Regulations (WAC 173-303). The applicant shall describe the treatment or disposition of all solid or semisolid construction and operation wastes including spent fuel, ash, sludge, and bottoms and shall show compliance with applicable state and local solid waste regulations.*

(4) Safety standards compliance — *The applicant shall identify all federal, state, and local health and safety standards that normally would be applicable to the construction and operation of a project of this nature and shall describe methods of compliance therewith.*

(5) Radiation levels — *For facilities that propose to release any radioactive materials, the applicant shall set forth information relating to radioactivity. Such information shall include background radiation levels of appropriate receptor media pertinent to the site. The applicant shall also describe the proposed radioactive waste treatment process, the anticipated release of radionuclides, their expected distribution and retention in the environment, the pathways that may become sources of radiation exposure, and projected resulting radiation doses to human populations. Other sources of radiation that may be associated with the project shall be described in all applications.*

4.1.1 Noise

This section presents an evaluation of potential noise resulting from the construction and operation of the Project. An essential part of this assessment is a comparison of expected noise levels from the Project with acceptable noise levels presented in applicable regulations.

4.1.1.1 Fundamentals of Acoustics

Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. There are several ways to measure noise, depending on the source of the noise, the receiver, and the reason for the noise measurement. Table 4.1.1-1 summarizes the technical noise terms used in this subsection.

Table 4.1.1-1
Definitions of Acoustical Terms

Term	Definitions
Ambient noise level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	Noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, time of occurrence, and tonal or informational content, as well as the prevailing ambient noise level.
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the reference pressure to the sound pressure, which is 20 micropascals (20 micronewtons per square meter).
Frequency (Hz)	The number of complete pressure fluctuations per second above and below atmospheric pressure.
Decibel A-weighted sound level (dBA)	The sound pressure level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighted filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted unless stated otherwise.
Decibel C-weighted sound level (dBC)	The sound pressure level in decibels as measured on a sound level meter using the C-weighted filter network. The C-weighted filter does not de-emphasize the very low and very high frequency components of the sound. It is a flatter weighting in that each frequency has an almost equal weighting. It is therefore more sensitive to low frequencies than the A-weighting.
Equivalent noise level (L_{eq})	The energy average A-weighted noise level during the measurement period.
Percentile noise level (L_n)	The A-weighted noise level exceeded during n % of the measurement period, where n is a number between 0 and 100 (e.g., L_{90})
Community noise equivalent level (CNEL)	The average A-weighted noise level during a 24-hour day, obtained after the addition of 5 decibels to sound levels from 7 p.m. to 10 p.m. and after the addition of 10 decibels to sound levels between 10 p.m. and 7 a.m.
Day-night noise level (L_{dn} or DNL)	The average A-weighted noise level during a 24-hour day, obtained after the addition of 10 decibels from 10 p.m. to 7 a.m.

Sources: Beranek, 1988; California Department of Health Services, 1977.

In this subsection, some statistical noise levels are stated in terms of decibels on the decibel A-weighted scale (dBA). Noise levels stated in terms of dBA reflect the response of the human ear by filtering out some of the noise in the low- and high-frequency ranges that the ear does not detect well. The A-weighted scale is used in most noise ordinances and standards. The equivalent sound pressure level (L_{eq}) is defined as the average noise level, on an energy basis, for a stated period of time (such as hourly).

In practice, the level of a sound source is typically measured using a sound level meter that includes an electrical filter corresponding to the A-weighted curve. The sound level meter also performs the calculations required to determine the L_{eq} for the measurement period. The following measurements relate to the noise level distribution during the measurement period. The L_{90} is a measurement that represents the noise level exceeded during 90 percent of the

measurement period. Similarly, the L_{10} represents the noise level exceeded for 10 percent of the measurement period.

The effects of noise on people fall into three general categories:

- Subjective effects of annoyance, nuisance, and dissatisfaction;
- Interference with such activities as speech, sleep, and learning;
- Physiological effects such as startling and hearing loss.

In most cases, environmental noise produces effects in the first two categories only. However, workers in industrial plants may experience noise effects in the third category. No completely satisfactory way exists to measure the subjective effects of noise, or to measure the corresponding reactions of annoyance and dissatisfaction. This lack of a common standard is primarily a result of the wide variation in individual thresholds of annoyance and habituation to noise. Thus, an important way of determining a person's subjective reaction to a new noise is by comparing it with the existing or "ambient" environment to which that person has adapted. In general, the more the level or the tonal (frequency) variations of a noise exceed the previously existing ambient noise level or tonal quality, the less acceptable the new noise will be, as judged by the exposed individual (CEC, 2001).

With regard to increases in A-weighted noise level, knowledge of the following relationships is helpful in understanding this subsection (Kryter, 1970):

- Except in carefully controlled laboratory experiments, the human ear cannot perceive a change of 1 decibel (dB).
- Outside the laboratory, a 3-dB change is considered a just-perceivable difference.
- A change in level of at least 5 dB is required before any noticeable change in community response can be expected.
- A 10-dB change is subjectively heard as approximately a doubling in loudness and would likely cause an adverse community response.

The referenced dB increases are for noise of similar nature (e.g., increased traffic noise compared with existing traffic noise). Table 4.1.1-2 shows the relative A-weighted noise levels of common sounds measured in the environment and in industry for various sound levels.

Table 4.1.1-2
Typical Sound Levels Measured in the Environment and Industry

Noise Source at a Given Distance	A-Weighted Sound Level in Decibels (dBA)	Noise Environment	Subjective Impression
	140		
Civil defense siren (100 feet)	130		
Jet takeoff (200 feet)	120		Pain threshold
	110	Rock music concert	
Pile driver (50 feet)	100		Very loud
Ambulance siren (100 feet)	—		
	90	Boiler room	
Freight cars (50 feet)	—	Printing press plant	
Pneumatic drill (50 feet)	80	In kitchen with garbage disposal running	
Freeway (100 feet)	—		
	70		Moderately loud
Vacuum cleaner (10 feet)	60	Data processing center	
Department store	—		
Light traffic (100 feet)	50	Private business office	
Large transformer (200 feet)	—		
	40		Quiet
Soft whisper (5 feet)	30	Quiet bedroom	
	20	Recording studio	
	10		Hearing threshold

Source: Peterson and Gross, 1974.

4.1.1.2 Noise Standards

173-60 WAC provides the applicable noise standards for Washington State, including Kittitas County. Kittitas County has not promulgated independent state-approved noise standards pursuant to WAC 173-60-110. WAC 173-60 establishes maximum permissible environmental noise levels. These levels are based on the environmental designation for noise abatement (EDNA) which is defined as “an area or zone (environment) within which maximum permissible noise levels are established. “ There are three EDNA designations (WAC 173-60-030), which roughly correspond to residential, commercial/recreational, and industrial/agricultural uses:

- Class A: Lands where people reside and sleep (such as residential)
- Class B: Lands requiring protection against noise interference with speech (such as commercial/recreational); and
- Class C: Lands where economic activities are of such a nature that higher noise levels are anticipated (such as industrial/agricultural).

As used in this section, “noise-sensitive areas” are equivalent to Class A EDNA areas. Table 4.1.1-3 summarizes the maximum permissible levels applicable to noise received at noise-

sensitive areas (Class A EDNA) and at industrial/agricultural areas (Class C EDNA) from an industrial facility (Class C EDNA).

**TABLE 4.1.1-3
State of Washington Noise Regulations (173-60-040 WAC)**

	Maximum Permissible Noise Levels (dBA) from a Class C EDNA		
Statistical Descriptor	Class A EDNA Receiver		Class C EDNA Receiver ¹
	Daytime (7 a.m. – 10 p.m.)	Nighttime (10 p.m. – 7 a.m.)	Anytime
L _{eq}	60	50	70
L ₂₅	65	55	75
L _{16.7}	70	60	80
L _{2.5}	75	65	85

Note: 1. Standard applies at the property line of the receiving property Source: WAC 173-60.

The following are exempted from the limits presented in Table 4.1.1-3 (per 173-60-050 WAC):

- Construction noise (including blasting) between the hours of 7 a.m. and 10 p.m.
- Motor vehicles when regulated by 173-62 WAC (“Motor Vehicle Noise Performance Standards” for vehicles operated on public highways)
- Motor vehicles operated off public highways, except when such noise affects residential receivers

Note that 173-60-50(6) WAC states, “Nothing in these exemptions is intended to preclude the Department from requiring installation of the best available noise abatement technology consistent with economic feasibility.”

173-62 WAC, “Motor Vehicle Noise Performance Standards,” regulates noise generated by vehicles traveling on public roads.

4.1.1.3 Affected Environment

As with most wind farms, this Project is located in a rural area with low population density and low ambient noise levels. The Applicant has entered into legal agreements with landowners controlling properties on which turbines will be erected and with several landowners who are near the Project. As part of those legal arrangements, a noise easement or option to purchase has been obtained for the parcels shown in Exhibit 21-1, ‘House and WTG Locations’. In this document, these parcels are referred to as participating landowners. Noise impacts to non-participating land owners are therefore the primary focus of this document. As shown in Exhibit 21-1, ‘House and WTG Locations’, the vast majority of the area surrounding the Project consists of participating land owners.

4.1.1.4 Environmental Impacts of the Proposed Action

4.1.1.4.1 Construction

Noise generated by construction of the Project is expected to vary, depending on the construction phase (see Section 2.12.2, ‘Construction Schedule, Activities and Milestones’).

Table 4.1.1-4 lists the typical noise levels associated with common construction equipment at various distances.

All noise generating construction activities will be conducted between the hours of 7 a.m. and 10 p.m. and are therefore exempt from the limits presented in Table 4.1.1.-3 (per 173-60-050 WAC). Blasting is anticipated for the foundations and potentially some road areas. Blasting will be conducted only between the hours of 7 a.m. and 10 p.m. and is anticipated to occur over a period of eight weeks. Blasting activities are specifically exempted from the noise regulations (per WAC 173-60-050 (1)(c)).

TABLE 4.1.1-4
Noise Levels from Common Construction Equipment at Various Distances (dBA)

Construction Equipment	Typical Pressure at 50 feet	Sound Level	Expected	Sound	Pressure
			Level at 1,000 feet	2,500 feet	5,000 feet
Bulldozer (250 to 700 horsepower)	88		62	54	43
Front-end loader (6 to 15 cubic yards)	88		62	54	43
Truck (200 to 400 horsepower)	86		60	52	41
Grader (13- to 16-foot blade)	85		59	51	40
Shovel (2 to 5 cubic yards)	84		58	50	39
Portable generators (50 to 200 kilowatts)	84		58	50	39
Mobile crane (11 to 20 tons)	83		57	49	38
Concrete pumps (30 to 150 cubic yards)	81		55	47	36
Tractor (3/4 to 2 cubic yards)	80		54	46	35

Source: Barnes et al., 1977.

4.1.1.4.2 Operation and Maintenance

Overall, wind turbines are typically quiet, especially when compared to their combustion-based alternatives. The noise generated by wind turbines is likely to be most noticeable at low wind speeds (8-10 mph) near the speed at which the wind turbines begin operating, when the background noise is at its lowest levels. Wind turbine noise tends to be masked by other background sources (i.e., the sound generated by the wind) at higher wind speeds.

The procedures for determining sound power levels from wind turbines are defined in International Electrotechnical Commission 61400 Wind Turbine Generator Systems Part 11: Acoustic Noise Measurement Techniques (Reference Number: IEC 61400-11:1998(E)). The measurement technique outlines procedures to determine corrections for background noise, apparent sound power level, and wind speed dependence.

Although the exact turbine model to be use for the Project has not been determined yet, representative values for the type of equipment being considered for this Project have been used. The turbines are expected to be warranted by the manufacturer not to exceed a maximum sound power level 104 dBA with a wind speed of 18 mph (8 meters per second) at 33-feet (10 meters) in accordance with the protocol established in IEC 61400. This is approximately equivalent to a sound pressure level of 72 dBA at 50 feet from the turbine. Measurements conducted by others at existing projects substantiate that the guaranteed sound power levels are realized under field conditions

4.1.1.5 Modeling Results and Regulatory Compliance

A three-dimensional noise model was developed using CADNA/A, a sophisticated program developed by DataKustik, GmbH, Munich, Germany. The algorithms in CADNA/A are based on the International Standard ISO –9613-2 “Attenuation of Sound During Propagation Outdoors”. Octave band sound power levels (determined in accordance with IEC 61400) for the wind turbines and topographic information from the USGS were input into the model.

The wind turbine noise emissions are required by 173-60 WAC not to exceed 70 dBA at all Class C EDNA (industrial/agricultural) property boundaries of non-participating land owners. The project will comply with this requirement at property boundaries of all non-participating landowners. In fact, the predicted property line noise levels are less than 60 dBA (see Table 4.1.1-5).

Non-participating residential daytime levels are required by 173-60 WAC not to exceed 60 dBA while nighttime levels are not to exceed 50 dBA. As shown in Exhibit 21-2, ‘Noise Impact Zones’, and summarized in Table 4.1.1-5, the project will comply with the more restrictive nighttime limit of 50 dBA at all existing residential structures owned by non-participating landowners. In fact, the project is anticipated to comply with the residential nighttime noise limit at all existing residences, participating or non-participating.

The Applicant is committed to designing and operating the Project in a manner that complies with all applicable noise standards.

**TABLE 4.1.1-5
Summary of Model Results at Nearby Non-Participating Landowners**

Map ID	Description	EDNA Classification	173-60 WAC Standard (dBA)	Predicted Noise Level Wind (dBA)	Noise from Project	Complies with Standard
117	Geisick Property Line	Class C	70	50		YES
117	Geisick Residence	Class A	50	46		YES
417	Nelson Property Line	Class C	70	56		YES
417	* Nelson Residence	Class A	50	48		YES
215	Schwab Property Line	Class C	70	52		YES
215	* Schwab Residence	Class A	50	42		YES
216	Oslund Property Line	Class C	70	46		YES
216	* Oslund Residence	Class A	50	43		YES
	US Timber Property Line	Class C	70	56		YES
	Burke Property Line	Class C	70	56		YES
	Thomas Property Line	Class C	70	56		YES

TABLE 4.1.1-5
Summary of Model Results at Nearby Non-Participating Landowners

Map ID	Description	EDNA Classification	173-60 WAC Standard (dBA)	Predicted Noise Level Wind (dBA)	from Project	Complies with Standard
	Swauk Valley Ranch Property Line	Class C	70	51		YES
	Kuhn Property Line	Class C	70	56		YES
	Gagnon Property Line	Class C	70	56		YES

Sources: 173-60 WAC and CH2M HILL. Refer to Exhibit 21-2, 'Noise Impact Zones', for predicted project noise contours.

Note: * These are recreational structures not occupied on a permanent basis and lack water and/or power.

4.1.1.6 Decommissioning

Decommissioning activities would be similar in type but shorter in duration compared to those anticipated for the construction phase. Noise generating decommissioning activities would be conducted between 7 a.m. and 10 p.m.

4.1.2 Risk of Fire or Explosion

4.1.2.1 Introduction

Unlike thermal power plants, wind power projects pose a much smaller risk of explosion or fire potential, as there is no need to transport, store or combust fuel to generate power. As with any major construction undertaking, construction of the Project does present some fire risks. Fire risk mitigation starts with Project design, especially with electrical design which needs to comply with the National Electric Code (NEC) and the National Fire Protection Agency (NFPA). A strict fire prevention plan will be enforced both during construction and operations to mitigate fire risks.

4.1.2.2 Fire and Explosion Sources and Mitigation Measures

The risk of unintentional or accidental fire or explosion during both construction and operations is minimal. As the Project site is generally arid rangeland with a predominant groundcover of grasses and sagebrush the highest expected fire risks are grass fires during the hot, dry summer season. Fire risk potential is constantly tracked and reported during the summer fire season by the DNR and this will be actively posted at the construction job site during the high risk season. The Project site roads act as firebreaks and also allow for quick access of fire trucks and personnel in the event of a grass fire.

The Construction Manager will be responsible for staying abreast of fire conditions in the Project area by contacting Washington DNR and implementing any necessary fire precautions.

A Fire Protection and Prevention Plan will be developed and implemented, in coordination with the Kittitas County Fire Marshal and other appropriate agencies. Table 4.1.2-1 lists sources of potential fire and explosion along with measures to mitigate the risk of either occurring.

The Applicant has already held meetings with the Kittitas County Fire Marshal and other local fire officials to discuss preventive measures during construction and operation of the Project. As some portions of the Project area are currently outside of existing fire districts, it is anticipated that the Applicant will enter into contract(s) for fire protection with local service providers during Project construction. This is discussed further in Section 5.3.2.2, 'Fire Services'.

Lightning induced fires are rare in the Project area and both the wind turbine generators and the substation are equipped with specially engineered lightning protection systems, as described in Section 2.3.6.1.11, 'Lightning Protection Systems'. As is the case with almost any complex machines, there is some potential for fire inside the wind turbine generators. With the types of modern wind turbines proposed for the Project, however, turbine malfunctions leading to fires in the nacelle are extremely rare. The turbine control system detects overheating in turbine machinery and internal fires would be detected by these sensors causing the machine to shutdown immediately and send an alarm signal to the central SCADA system which would notify operators of the alarm by cell phone or pager.

**Table 4.1.2-1
Fire and Explosion Risk Mitigation Plan**

C / O *	Potential Fire or Explosion Source	Mitigation Measures
C & O	General Fire Protection	<ul style="list-style-type: none"> • All on-site service vehicles fitted with fire extinguishers • Fire station boxes with shovels, water tank sprayers, etc. installed at multiple locations on-site along roadways during summer fire season • Minimum of 1 water truck with sprayers must be present on each turbine string road with construction activities during fire season
C & O	Dry vegetation in contact with hot exhaust catalytic converters under vehicles	<ul style="list-style-type: none"> • No gas powered vehicles allowed outside of graveled areas • Mainly diesel vehicles (i.e. w/o catalytic converters) used on site • Use of high clearance vehicles on site if used off-road
C & O	Smoking	<ul style="list-style-type: none"> • Restricted to designated areas (outdoor gravel covered areas)
C & O	Explosives used during blasting for excavation work	<ul style="list-style-type: none"> • Only state licensed explosive specialist contractors are allowed to perform this work – explosives require special detonation equipment with safety lockouts • Clear vegetation from the general footprint area surrounding the excavation zone to be blasted • Standby water spray trucks and fire suppression equipment to be present during blasting activities
C & O	Electrical fires	<ul style="list-style-type: none"> • Use of generally high clearance vehicles on site • No gas powered vehicles allowed outside of graveled areas • All major construction equipment is diesel powered (i.e. w/o catalytic converters) used
C & O	Lightning	<ul style="list-style-type: none"> • Specially engineered lightning protection and grounding systems used at wind turbines and at substation • Footprint areas around turbines and substation are graveled with no vegetation

**Table 4.1.2-1
Fire and Explosion Risk Mitigation Plan**

C	Portable Generators – hot exhaust	<ul style="list-style-type: none"> Generators not allowed to operate on open grass areas All portable generators to be fitted with spark arrestors on exhaust system
C	Torches or field welding on-site	<ul style="list-style-type: none"> Immediate surrounding area will be wetted with water sprayer Fire suppression equipment to be present at location of welder/torch activity
C & O	Electrical arcing	<ul style="list-style-type: none"> Electrical designs and construction specifications meet or exceed requirements of NEC and NFPA
* Indicates risk during construction (C) and/or operations (O)		

The potential fire risks are similar in nature but lower for Project decommissioning and fire prevention measures during decommissioning would be similar to those for Project construction.

4.1.3 Releases or Potential Releases of Hazardous Material to the Environment

4.1.3.1 Construction

Diesel fuel is the only potentially hazardous material that will be used in any significant quantity during construction of the Project. Construction of the Project will require the use of diesel fuel for operating construction equipment and vehicles. Measures to prevent and contain any accidental spills resulting from this fuel storage and use are described in detail in Section 2.9.2.1 'Construction Spillage Prevention'. Construction of the project will not result in the generation of any hazardous wastes in quantities regulated by state or federal law. During construction, the primary wastes generated will be solid construction debris such as scrap metal, cable, wire, wood pallets, plastic packaging materials and cardboard. The total volume of construction wastes is expected to be less than ten tons. This waste will be accumulated on site in drop boxes until hauled away to a licensed transfer station or landfill by either the EPC contractor or a local solid waste collection service provider, probably Waste Management, which has the franchise for solid waste collection service in Kittitas County.

4.1.3.2 Operations

Operation of the Project will not result in the generation of regulated quantities of hazardous wastes. As no fuel is burned to power the wind turbine generators, there will be no spent fuel, ash, sludge or other process wastes generated. The primary type of waste generated by operations the Project will be municipal solid waste generated at the Operations and Maintenance facility, consisting of typical office wastes (paper, cardboard, food waste, etc.) which will be stored in a dumpster until it is collected by the local solid waste collection service provider (currently Waste Management has this franchise for Kittitas County.) Periodic changing of lubricating oils and hydraulic fluids used in the individual wind turbine generators (WTGs) will also result in the generation of small quantities of these materials. These waste fluids will be generated in small

quantities because they need to be changed only infrequently and the changing of these fluids is not done all at once, but rather on an individual WTG by WTG basis. These waste fluids will be stored for short periods of time in appropriate containers at the O&M facility for collection by a licensed collection service for recycling or disposal. Procedures for collecting, storing and transporting these materials for recycling or disposal are described in detail in Section 2.9.2.2 'Operations Spill Prevention'.

4.1.4 Safety Standards Compliance

The Applicant and its subcontractors will comply with all applicable local, state and federal safety, health, and environmental laws, ordinances, regulations, and standards. Some of the main laws, ordinances, regulations and standards (LORS) that will be reflected in the design, construction, and operation of the Project are as follows: Occupational Safety And Health Act Of 1970 (29 U.S.C. 651, et seq.) and 29 CFR 1910, Occupational Safety and Health Standards; Uniform Fire Code; Americans with Disabilities Act; Uniform Fire Code Standards; Uniform Building Code; National Fire Protection Association, which provides design standards for the requirements of fire protection systems; National Institute For Occupational Safety And Health (NIOSH), which requires that safety equipment carry markings, numbers, or certificates of approval for stated standards; American Society Of Mechanical Engineers, which provides plant design standards; American National Standards Institute, which provides plant design standards; National Electric Safety Code; American Concrete Institute Standards; American Institute of Steel Construction Standards; American National Standards Institute; American Society for Testing and Materials; Institute of Electrical and Electronic and Installation Engineers; and the National Electric Code .

4.1.5 Radiation

Pursuant to WAC 463-42-115 the Applicant requests a waiver of the requirements of the information required by WAC 463-42-352(5) which calls for information relating to radioactivity. No radioactive materials will be used, consumed, or released during construction or operation of the Project.